7th Informal workshop on coastal circulation modeling around New England
May 2008
Minutes

- ## Present:
    - Jim Manning (NOAA/NEFSC)
    - Rich Signell (USGS)
    - Huijie Xue (UMO)
    - Fei Chai (UMO)
    - Avijit Gangopadhyay (SMAST)
    - Andre Schmidt (SMAST)
    - Filipe Fernandes (SMAST)
    - Akankshu Dhawan (UMass Dartmouth)
    - Vitalii Sheremet (URI)
    - Ernie True (Norwich)
    - Bob Beardsley (WHOI)
    - Changsheng Chen (SMAST)
    - Bob Groman (WHOI)
    - Scott Gallager (WHOI)
    - Maureen Taylor (NOAA/NEFSC)
    - Bill Overholtz (NOAA/NEFSC)
    - Rubao Ji (WHOI)

- ## Presentations:
    - **quick intro and review of previous workshops** (NOAA Jim)
        - Notes on the informality of our relationships, no obligations, no funding organization
        - 2003 questionnaire to local modelers showed that workshops are needed to share ideas on grid generation, wind forcings, open boundaries, visualization, and validation. The topic of "core model" scored the least votes on what is important.
        - Since 2003 we have had several workshops where at least 6 labs were represented
        - Beginning this year, we are organizing ourselves under the "Gulf of Maine Ocean Data Partnership Modeling Subcommittee"
        - Draft agenda and meeting logistics

- **A Multiscale Operational set up for MARCOOS including the Gulf of Maine** (UMASSD Avijit)
  - Blumberg & Wilkin also run models in the Mid Atlantic Bight under MARACOOS
  - Avijit's UMASSD HOPS grid includes GoM
  - Introduced fellow modelers/students Andre Schmidt, Filipe Fernandes, and Akankshu Dhawan
  - Feature models, frontal analysis, HOPS
  - Composite circulation of GOM using initialization technique of pseudo-CTDs from SST
  - 3 parts: initialization, validation via simulation, hindcast verification
  - Gulf Stream predictability to 10-14 days
  - System
    - Start with combination of GOOS 4km resolution SST and John Hopkins frontal analysis
    - Limitation due to altimeter problems on the onshore side of the Gulf Stream (GS) so GS warm core rings don't show up
    - Identifies center point of rings
  - Brown et al 2007a,b in Jour Oceanic Engineering describes the system using SST and XBT assimilation
  - Model setup
    - 15km w/16 sigma levels
    - Initially run with no forcing
    - Grid extends from Cape Hatteras to Grand Banks
  - Results see features in Aug 2006 w/30 day run
  - Movies of vertical & horizontal structure
  - Future SSH, forcing NCEP, interdisciplinary
  - Signell asked about and discussed the topics of "spectral filtering" like that used by Keith Thompson to nudge back towards climatology

- **FVCOM experiences at UMASSD/WHOI update** (Chen)
  - Update on FVCOM
    - Many modules like 3-d wet/dry, sediment, biological, water quality, multi-OB, lagrangian tracking (slow real-time and faster off line), ice model…
    - Many methods of nudging, Kalman filtering, field sampling, surface wave, autogrid adjustment, etc
    - Upgrading to non-hydrostatic K-stage in the future
  - Example Multi-scale Applications:
    - Global
    - Pan-arctic

- NERACOOS (2nd generation is 0.5 to 1km while the 3rd generation is 300m-1km) with terrain-following,
- coastal (<20m) models like Mass Bay, Penobscot Bay
- Pictures online but disk space a limitation for data
  - USCG is allowed access to the output
    - some discussion followed about access by the general public as well
    - there may be a chance to at least post surface values in the near future
  - Resolution can be increased anywhere!
  - "NEFCOS" operational forecast system
    - MM5,WRF
      - 3 domains
      - Assimilate WRF model SST
      - Discussion
    - Automation schedule: JPL SST obtained and updated with OI assimilation, WRF hindcast & forecast, river, with nobody actually funded in maintaining this... fully automated
    - See Fvcom.smast.umassd.edu to select domain, time, different forcing,
    - Question is do fishermen know about this. Apparently some do but it is not advertized much.
  - Recent
    - CICE
    - SWAN vs buoy data "height" good but "period" off
    - Internal waves under investigation

- **Collaboration Tools** (USGS Signell)
  - It is hard to decide exactly how to present/display model data on the web to satisfy all users
  - Matlab and IDV viewers allow us to look at sections in the way we want as scientist
  - This activity comes under the auspices of GOMODP where data authority, discoverability, accessibility, and interoperability is the primary goal and a modeling subcommittee has been set up
  - To demonstrate the new system (borrowed from the UNIDATA meteorologist) test cases using UMaine, UMass Boston, UMass Dartmouth, WHOI with different netCDF model output
  - Simple netCDF file described but there are many flavors of this "standard" so the IPCC model groups came up with the CF convention as shown in a CF-compliant ROMS output
  - "Formula terms" solved the problem of curvilinear grids
  - NcML is a markup language that changes info in an netCDF file without actually modifying the file which makes the non-compliant

netCDF compliant and you can aggregate multiple files with one of these XML files
- netCDF Java library reads these both regular netCDf files AND these NcML files developed by Unidata
- One calls these java routines (Matlab example shown) to get the data without really needing to know what model it is from and the structure of the model
- One can serve data or model output through a "THREDDS Data Server"
  - serves it via a catalog which then can be accessed by OPeNDAP or OpenGIS
  - compatible with Web Coverage Service
- Example shows comparison of models which can be different
- Examples comparing model and buoys
- IDV good for visualization

- **BCO-DMO and modeling data** (WHOI Bob Groman)
  - Missed this talk as I was preparing the lunch table but folks can see the website he described at http://www.bco-dmo.org/ Click on "Data Systems" and try out the various interfaces like the MapServer presentation of Georges Bank GLOBEC data
  - The Biological and Chemical Oceanography Data Management Office (BCO-DMO) was created in late 2006 to serve PIs funded by the NSF Biological and Chemical Oceanography Sections.
  - BCO-DMO is the combination of the US JGOFS and US GLOBEC data management offices.
  - Data are stored locally and remotely. BCO-DMO maintains a metadata database locally in order to make accessible marine biogeochemical and ecological data and information for the short and intermediate time frames.
  - BCO-DMO has a stewardship philosophy of data management. They insure that the data are of high quality and treat all information as data. Data that lack sufficient metadata has limited value beyond the research program for which it was collected so the metadata must include sufficienet information to support discovery, value assessment and accurate re-use of the data.
  - Geospatial access to the data is proviced via the MapServer software (University of Minnasota). Open Geospatial Consortium's Web Mapping Service and Web Feature Service protocols are provided in addition to supporting downloads as CSV, TSV, Matlab binary, and ASCII files. They will be adding NetCDF support as well.
  - Currently, the different dataset (US JGOFS, US GLOBEC, and Northeast Consortium, have separate MapServer interfaces but soon all the data will be integrated together providing access to

data via geographic boundaries, date, investigator names, data type, etc.

- o **Locally-developed Seahorse Tilt Current Meter for validating ocean models** (Vitalii Sheremet URI)
    - Describe physical principle of using an internally recording 3-axis tilt meter mounted on length of 1" PVC pipe that is anchored to the bottom
    - Showed comparisons with SonTek acoustic instrumentation in local waters with agreement within 2 cm/s
    - Ideal instrument in that it is sleek and does not foul (sheds seaweed easily unlike cumbersome commercial units)
    - Most importantly it only costs a few hundred dollars rather than several thousand
    - Comes in various lengths for investigating shear, for example, and shallow water environments but also performs at depth
    - Can be programmed to sample at very high rates
    - Many aspects like adding digital compasses and delivering data to satellite are still a long ways to be developed but the basic instrument is ready to use
    - Already used in Woods Hole Harbor, Waquoit Bay, Stellwagen Bank, and Narragansett Bay
    - Some discussion of the fact that there may be problems in wave-dominated environments

- o 12:15 lunch

- o **POM experiences at UMO update** (Huijie Xue)
    - Inputs rivers, tides, OBCs, and wind to predicted ocean conditions
    - Change made to operational system in 2007 when NOAA changed from COFS to RTOFS and also went from 48 to 60 hr predication
    - Operational mode archived with 3 hourly data from Jan 2002 to Aug 2007 and now w/new system Jan 2007 w/NAM met data
    - Hindcast 1984-present is also available in archived form
    - Comparisons with GoMOOS buoy I shows good skill in:
        - seasonal cycle not changing over the years (i.e. no change of skill)
        - Tidal compared at 5 buoys looks ok
        - Weather Band better in winter than summer
    - Response to Northeasters
        - Model response is longer than observations in both currents for first storm in May 2005. The prediction for the event in late May agrees better
        - Wind forecast is good

- Temperature & salinity structure might be missing and the reason for the slow response
  - Interannual comparison of various regions in the GoM (JB, EMC,WB,WMC)
    - Trouble with NCEP changing sign of heat flux in 2006 needs to be fixed in the archive
    - Monthly transport anomaly sensitive to the selection of the offshore limit as the coastal current moves laterally
    - Some over predicted upcoast current in winter
  - Coupled Biology Physics Model advection schemed MPDATA_t5, MPDATA_t1, MUSCL, MUSCL_VD compared
    - MPDATDA- Monotonic Positive Definite Advection Transport Algorithm
    - MUSCL- Multidimensional Pos Def Advection transport Algorithm
    - Liu & Xue submitted to Ocean Mod shows results very sensitive on advection schemes
    - Modified Van Deer looks best
    - Showed results on cross-section over GB. Jordan Basin, and EMC in comparison with salinity distribution
  - Lobster application w/temp dependent growth through various stages
    - Releases from various lobster zones at 15m but come to surface at stage 4
    - Connectivity matrix showed high retention and prevailing counterclockwise transport
    - Some discussion of random kicks at the boundary
    - Some discussion on horizontal random walk sensitivity
  - Examples of web served data and OpenDX & googleEarth visualization

- o **Environmental Monitors on Lobster Traps** (NEFSC Manning)
  - Source of multi-year bottom temperatures and surface currents from sensors on 100+ lobster traps and homemade GPS drifters, respectively
  - Gulf of Maine Coverage good (except lobster traps concentrated in coastal fishing area & shelf edge)
  - Data available either through http://emolt.org or OPeNDAP at http://gisweb.wh.whoi.edu:8080/dods/whoi
  - Modelers are encourage to use this data
  - Drifter statistics report submitted to CSR in Apr 2008
  - Other data like CTD and alongtrack available at the NEFSC oceanography website at: http://www.nefsc.noaa.gov/epd/ocean/MainPage
  - Latest drifter tracks available at http://www.nefsc.noaa.gov/drifter

- o **ROMS application in the GoM** (Manning for R He at NCSU)
  - Presented Ruoying's latest forecast at:
    http://omglnx3.meas.ncsu.edu/yli/08forecast/
  - Shows good agreement with observed concentration of Alexandrium counts derived from McGillicuddy's shipboard observations
  - Model seems to be driving the ship track of OCEANUS in 2008 where there is apparently a higher than normal event currently underway in the Western Gulf
  - Drifters deployed the night before this meeting and the morning of the meeting shown off Cape Ann and Casco Bay at
    http://www.nefsc.noaa.gov/drifter/

- o **Northeast Biological Observing System** (Scott Gallager WHOI)
  - Demo of google Earth access of images but most importantly the image analysis products like diversity, species composition, etc
  - Now available to Google Earth community
  - Fast processing on ship needed to handle all the data
  - Small scale gridded studies in and out of troughs shows anisotropy of animals relative to sand waves
  - Wondered if there was transport of larval scallops towards the southwest? high density area off Cape Hatteras

- o **Biogeochemical model for GoM** (Fei Chai UMO)
  - Ecosystem link to GoMOOS system (originally developed for Pacific)
  - Long-term simulation 1984-present
  - Different advection schemes results in difference in, for example, monthly average Chl-a
  - Compared buoy, model, SeaWifs
  - Use UNH PULSE monthly samples to get seasonal cycles of nutrients (nitrate example)
  - >100 Sensitivity studies on multiple parameters like changing nutrient values at the boundary and light for example
  - Vis5ncD visualization demo off Galapagos Island

- o **Collaboration tools demos** (Rich Signell USGS)
  - Java utilities where you start with a simple url and bring fields into MATLAB environment
  - Brings in usable variables like t, lat, lon, etc
  - One glitch for unstructured grids is that there is no connectivity array in CF compliant files but there is an easy fix where you use something called nj_varget
  - Vertical positions, time, etc is ok
  - Step by step guide to apply to MATLAB is on gomodp.org website

- Bathy data access demo using this system shows how a user can grab a section of US shelf and access the high resolution (~3 sec) topo data in a matter of seconds
- Showed how NcML can redo a netCDF like z values in POM
- NCWMS Google earth uses GeoServer (google "godiva2" to find more info) creates image that you can load in Google Earth
- Reference to Signell et al JMS paper Collaboration Tools & techniques

- Future Meetings to note:
  - July 17-18, 2008 Horn Point Maryland workshop on LTRANS: a generic open source particle tracking code for netCDF model output developed by Elizabeth North and colleagues
  - Sept 22-23, 2008 Woods Hole Mid-Atlantic Bight Phys. Ocean and Meteorology Meeting see http://nefsc.noaa.gov/epd/ocean/MainPage/mabpom2008.html

General Meeting Conclusions:
  - Modelers will work to post output in netCDF formatted files and serve them via Thredds or other servers such as OPeNDAP, OGC, etc as soon as output is available
  - Users are cautioned that all model output is experimental and will continually be improved over time
  - CF-compliant format is recommended but not necessary given that NcML files can correct for missing variables
  - A variety of java utilities (developed originally by the meteorologist) can be used to access and visualized ocean model output in MATLAB and IDV
  - Several labs around New England are running various models on the GoM including, for example, POM, ROMS, QUODDY, HOPS, and FVCOM and, with this new model-output-access-protocol, we can begin to view, compare, and average results similar to the way meteorologist do with multiple models.
  - Different advection schemes produce very different results
  - A variety of data is available for initialization, assimilation, and validation of GoM models and should be accessible on servers the same way the model output should be
  - A new inexpensive bottom current meter being developed this spring and summer has potential to help validate models
  - Biological Observing Systems are being developed alongside traditional physical measurements and can be utilized by ecosystem modelers